

FIG. 1 Prior Art

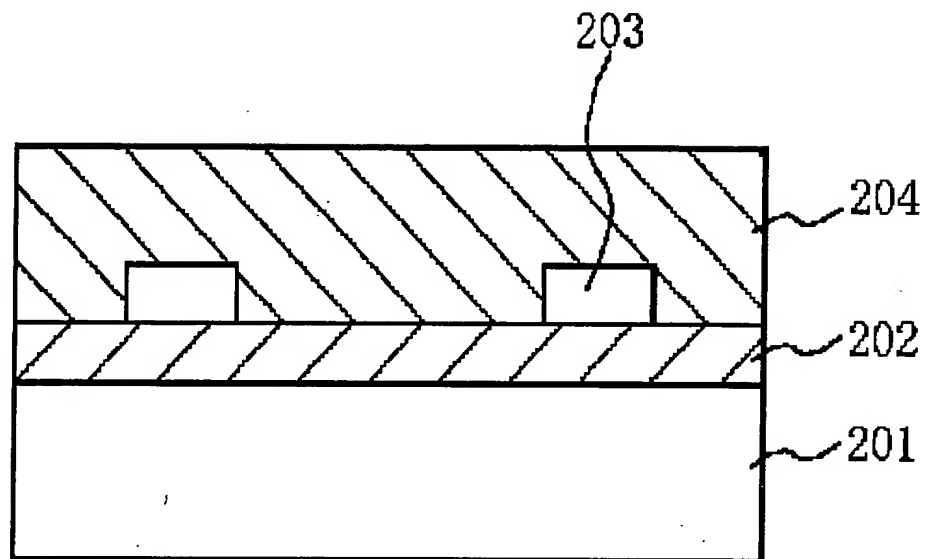


FIG. 2

CONSTITUTIVE MATERIAL	THERMAL EXPANSION COEFFICIENT
SiO ₂	0.528
SiN	2.791
SiON	2.708
SiC	7.412
SiCN	4.885
L-Ox(SiOH)	17.189
SiOC	11

$[\times 10^{-6} / \text{K}]$

FIG. 3

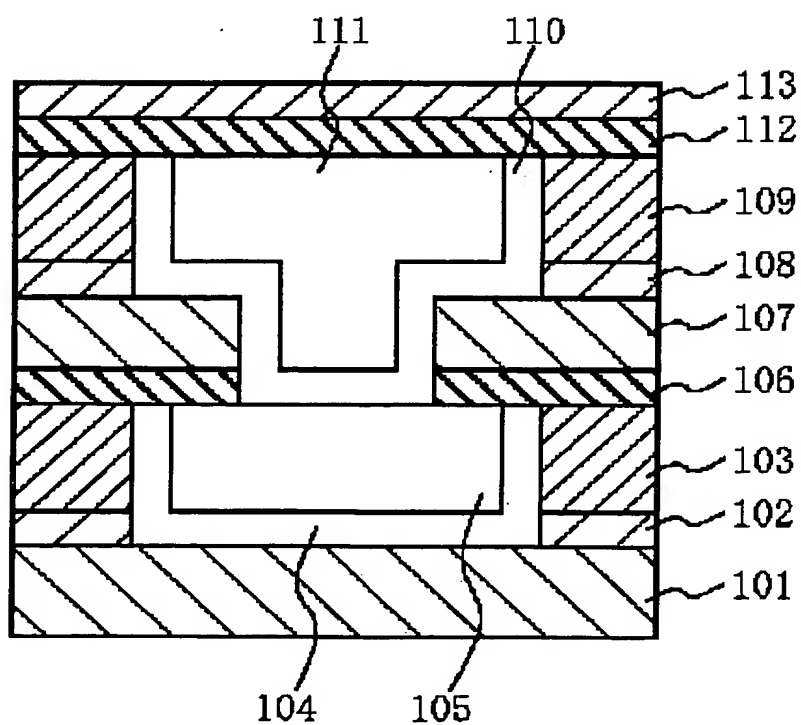


FIG. 4

PATTERN	INTERLAYER FILM STRUCTURE (cap/IMD/stopper/ILD)	STRESS [MPa]	RESISTANCE CHANGE [%]
1	SiN/SiO ₂ /SiON/SiO ₂	65.7	30
2	SiN/L-Ox/SiON/SiO ₂	45.2	20
3	SiN/L-Ox/SiC/SiO ₂	42.9	8
4	SiN/L-Ox/stopperless/SiO ₂	39.0	4

FIG. 5

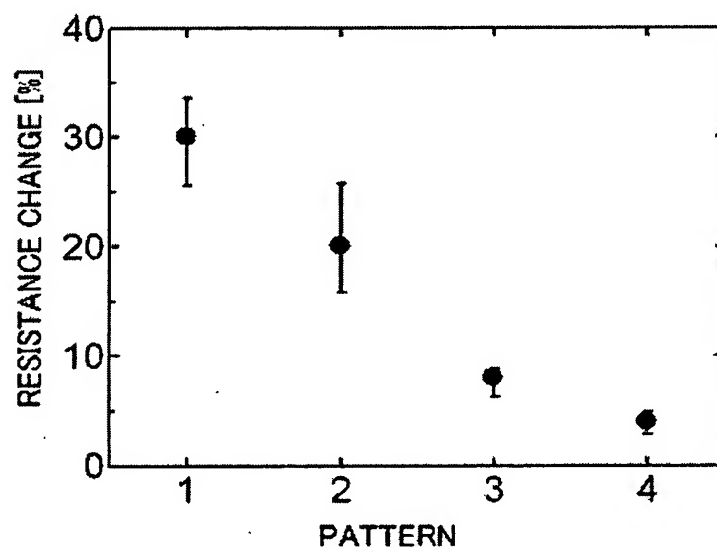


FIG. 6

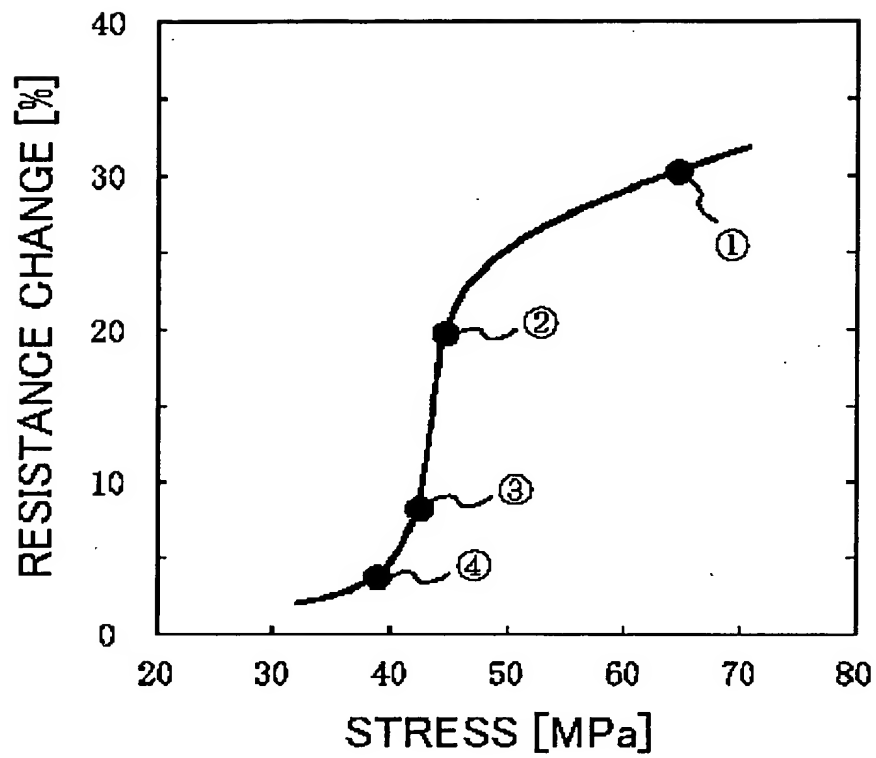


FIG. 7

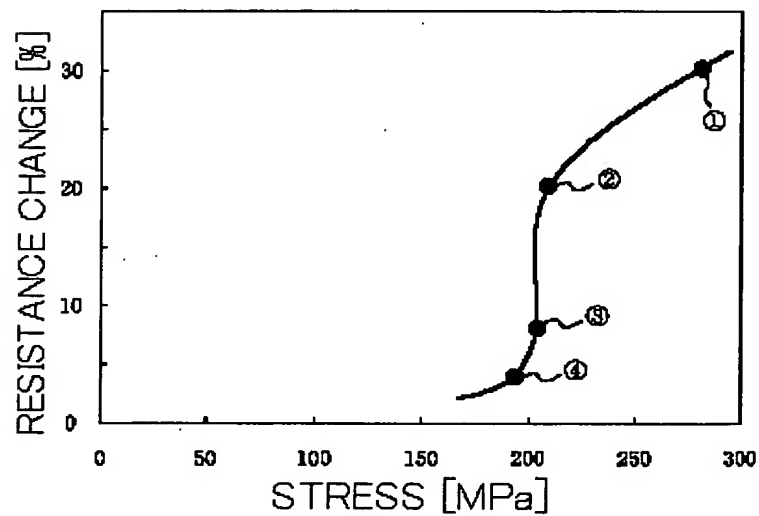


FIG. 8

PATTERN	INTERLAYER STRUCTURE	RELATIVE INTERLAYER THICKNESS					T _{process} max [°C]						
		cap	IMD	stopper	ILD	TOTAL	α die	450	425	400	375	350	
1	SiN/SiO ₂ /SiCN/SiO ₂	7	20	5	45	77	0.88	410.52	342.1	278.88	205.28	138.84	68.42
2	SiN/L-Ox/SiCN/SiO ₂	7	20	5	45	77	5.2	308.78	255.85	204.52	163.38	102.26	51.13
3	SiN/L-Ox/SiC/SiO ₂	7	20	5	45	77	5.51	288.48	249.55	199.64	149.73	99.82	49.81
4	SiN/L-Ox/stopperless/SiO ₂	7	25		45	77	8.14	284.24	236.87	188.49	142.12	94.75	47.37
5	SiN/SiO ₂ /SiC/SiO ₂	7	20	5	45	77	1.18	403.2	338	268.8	201.6	134.4	67.2
6	SiCN/SiO ₂ /SiC/SiO ₂	7	20	5	45	77	1.37	398.64	332.2	265.78	198.32	132.88	66.44
7	SiCN/L-Ox/SiC/SiO ₂	7	20	5	45	77	5.7	284.9	245.75	196.6	147.45	98.3	49.15
8	SiCN/L-Ox/SiCN/SiO ₂	7	21	5	34	67	0.53	274.95	229.13	183.3	137.48	91.85	45.83
9	SiCN/SiO ₂ /SiCN	7	48	5		80	0.89	407.72	338.77	274.81	203.86	136.91	67.85
10	SiN/SiO ₂ /SiCN	5	55	5		85	1.04	406.64	338.57	271.09	203.32	135.55	67.77
11	SiCN/SiO ₂ /SiOC	10	7	40		57	8.64	224.38	188.98	149.57	112.18	74.79	37.36
12	SiCN/SiO ₂	20	130			150	1.11	404.92	337.44	269.95	202.46	134.97	67.49
13	SiCN/SiO ₂ /SiOC	15	57	40		112	4.85	315.2	262.67	210.14	157.6	105.07	52.53
14	SiCN/SiO ₂	22	183			205	1	407.84	339.7	271.76	203.82	136.88	67.84
15	SiCN/SiO ₂ /SiOC	5	8	72		80	10.23	186.38	155.32	124.26	93.19	62.13	31.08